Conclusions
This study showed that successful cather ablation can improve LA function of patients with drug-refractory PAF.

1038-154 Pharmacologic and Carbon Dioxide Reactivity of Coronary Circulation as Determined by Computed Tomography Perfusion

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Background
Dobutamine and dipyridamole are routinely used to activate coronary perfusion reserve to detect ischemia. This study investigates the different effects of these two drugs on coronary circulation and compare them to arterial carbon dioxide tension (P_aCO_2).
Methods
8 dogs were used to study coronary perfusion reactivity to arterial P_aCO2 (n = 3), dobutamine (DOB, n = 4) and dipyridamole (DIP, n = 1). Myocardial perfusion (MBF), blood volume (MBV) and mean transit time (MTT) were measured in each study by injecting a bolus of contrast followed by cine CT scanning for 30 s using a General Electric Medical Systems (GEMS) LightSpeed Plus multi-slice CT scanner. Reconstructed images at end-diastole were selected to generate functional maps using CT Perfusion (GEMS). For P_aCO2 studies, measurements on each dog were taken twice at hypo- (24 ± 4 mmHg), normo- (33 ± 5 mmHg) and hyper-capnia (50 ± 5 mmHg). For DOB studies, measurements on each dog were repeated once both before and after constant infusion of DOB for 7 minutes (0.25 mg/kg). For DIP studies, repeat measurements were also obtained before and after DIP infusion for 4 minutes (0.56 mg/kg).
Results
DIP, DOB and hypercapnia increased MBF by 3.2, 3.3 and 2.0 times relative to baseline respectively ($p < 0.05$). Both drug-induced increases in MBF were different from that at hypercapnia ($p < 0.01$). MBV increased by 1.5 times at hypercapnia ($p < 0.05$) and with DIP stress ($p > 0.05$) relative to baseline, while with DOB the increase was 3.1 times ($p < 0.01$) and was different from the increase at hypercapnia ($p < 0.01$) and with DIP stress ($p < 0.05$). Significant reduction in MTT was seen at hypercapnia (0.7 times, $p < 0.01$) and with DIP stress (0.5 times, $p < 0.05$) relative to baseline, but not with DOB (1.0 times, $p > 0.1$). All functional parameters were not different between hypo- and normo-capnia ($p > 0.05$).
Conclusion
These preliminary findings suggested that DIP increases MBF by coronary vasodilation since there is a moderate increase in MBV and a large decrease in MTT. In contrast, DOB increases MBF via coronary recruitment since there is a large increase in MBV and essentially no change in MTT. Furthermore, coronary circulation is more responsive to hypercapnia than hypocapnia.

POSTER SESSION

1054 The Bench Leads to Bedside...Eventually

Sunday, March 07, 2004, 3:00 p.m.-5:00 p.m.
Morial Convention Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1054-145 Murine Cardiac Failure Model Produced by High-Intensity Focused Ultrasound

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Background: High intensity focused ultrasound (HIFU) produces immediate focal lesions with intense focused ultrasound exposures within short periods. Previously we reported on the feasibility of creating thermal lesions using HIFU in in-vitro cardiac tissues. Currently, heart failure models are created by ligation of LAD, a technique requiring significant training. We hypothesized that murine myocardial failure models may be created using HIFU which would be simpler to perform than coronary ligation. The purpose of this study was to assess the feasibility of cardiac failure model creation using HIFU in mice.
Methods: We studied 20 wild type mice (HIFU group). They were anesthetized and underwent a left sided thoracotomy. The frequency of the transducer was 4.67 MHz, and the focal zone was 10mm depth × 1.1 mm wide which was 25 mm from the transducer. HIFU transducer surface was coupled with the left ventricular (LV) anterior wall using gel and water bath. The focal point was set at the middle of LV wall. We used one second duration of HIFU energy discharge (19.7kW/cm^2) three times for each mouse. As a control group, 10 mice underwent identical procedure without HIFU discharge (Control). Before and at 4 weeks from procedure, we assessed the LV diameter at end-systole (Ds) and end-diastole (Dd) and ejection fraction (EF) using a high frequency ultrasound system in both groups.
Results: The mortality of HIFU group was 25%. There was no significant difference of LV Dd/Ds between the two groups before ablation (HIFU group vs. Control; 2.67±0.2/1.35±0.17 vs. 2.59±0.24/1.34±0.15 mm, respectively). At 4 weeks, LV diameter in HIFU group was significantly increased (3.54±0.54 vs. 2.67±0.2 mm, $p<0.01$). Before HIFU ablation, there was no significant difference of LVEF between the two groups. LVEF in control group did not changed significantly. However, LVEF in HIFU group was significantly reduced after HIFU ablation (69.7±5.3% vs 48.4±13.7%, respectively; $p<0.01$). Histopathological study showed a necrotic area around the ablation site and LV remodeling.
Conclusion: HIFU can produce LV dilatation and systolic dysfunction in mice. HIFU may be used to create a murine myocardial failure model.

1054-146 Feasibility of Focal Septal Myocardial Ablation Through the Right Ventricle Using High-Intensity Focused Ultrasound

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Background: High intensity focused ultrasound (HIFU) is used clinically for ablating solid tumors and for creating intra-ophthalmic lesions. However potential cardiac applications have been limited. We have previously demonstrated the ability of HIFU to create focal lesions in the myocardium. An important, potential use of HIFU is ablation of left ventricular (LV) septal tissue in patients with hypertrophic cardiomyopathy. In this case, it is necessary to focus the beam through the right ventricular (RV) free wall at the septum without damaging intervening tissue. The purpose of this study was to create a precise, focal lesion in the LV septum without affecting the RV free wall.
Method: The LV septum with overlying RV free wall of a calf heart was placed in degassed saline bath at 37ºC. The operating frequency of the transducer was 4.67MHz with an acoustic power of 26.9kW/cm^2. Our HIFU machine is designed to create a focal zone 10.0-mm×1.0-mm, at a depth of 25-mm from the transducer. The transducer was coupled to the surface of the RV free wall using ultrasound gel and focused on the ventricular septum. In order to simulate ablation during cardiac contractions, the HIFU transducer was set to deliver ten 0.4 second duration pulses over a 10 second period. Four lesions were created in different septal areas by moving the transducer. All specimens were cut and histopathological sections prepared in order to determine lesion size.
Result: All lesions were visibly detected. The mean lesion size in the septum was 3.5±0.7 mm^2. No visible or histological damage of the RV free wall was detected in the path of the HIFU beam.
Conclusion: HIFU creates well demarcated lesions in the LV septum without damaging intervening tissue. With further development, this device may prove useful for LV septal ablation in patients with hypertrophic cardiomyopathy.

1054-147 Use of Color M-Mode Tissue Doppler Imaging to Calculate Dynamic Compliance of the Pulmonary Arteries in Pulmonary Hypertension: Validation in an Animal Model

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Background: We have previously shown that dynamic compliance (C_{dyn}) of the pulmonary artery (PA) provides important information on reactivity in patients with pulmonary hypertension (PHT). However C_{dyn} requires invasive measurements. We have recently developed a non-invasive method to assess C_{dyn} using color M-mode tissue Doppler imaging (CMM-TDI). Here we validate this method in an animal model of PHT. **Methods:** This study was performed in 7 anaesthetized dogs with no underlying PHT at baseline and after infusion of 3 doses of a vasoconstrictor (thromboxane mimetic U46619). CMM-TDI velocities from right PA walls were integrated using a custom algorithm to produce instantaneous diameter. Compliance was calculated as: C_{dyn} (% diameter change / 100 mm Hg) = [((Ds – Dd)/(Ps x Dd) x 10^4); Ds, Dd = systolic, diastolic diameter; Ps = Peak PA pressure] for all conditions (N = 30). **Results:** CMM-TDI provided consistently superior diameter measurements when compared to M-mode. A non-linear relationship between C_{dyn} and mean PA pressure was found (Figure), showing decreased compliance with increasing PA pressure, indicative of strain-stiffening behavior expected from the non-linear mechanics of these arteries. **Conclusion:** CMM-TDI allows compliance of the pulmonary vasculature to be obtained non-invasively. This method adds an important tool to pulmonary reactivity evaluation.